Claims

1. An electronic system, comprising a single device having a light emitting portion and a magnetically sensitive portion, wherein said magnetically sensitive portion is for modulating light emission from the light emitting portion.

2. An electronic system, as recited in claim 1, wherein said device is for converting a magnetic digital signal directly into an optical digital signal.

3. An electronic system, as recited in claim 2, wherein said system is for converting said magnetic digital signal to both an electrical digital signal and into said optical digital signal, wherein either or both of said signals can be provided as a device output.

4. An electronic system, as recited in claim 1, wherein said magnetically sensitive portion comprises a magnetically permeable material.

5. An electronic system, as recited in claim 1, wherein said device comprises a three-terminal light-emitting transistor, said transistor comprising an emitter, a base, and a collector, wherein said light is emitted from said collector.

6. An electronic system, as recited in claim 5, wherein said base comprises said magnetically sensitive portion for receiving a digital magnetic control signal, wherein said magnetically sensitive portion comprises a magnetic switch, wherein switch position is determined by said digital magnetic control signal, wherein a first intensity of light is emitted in a first switch position and a second intensity of light is emitted in a second switch position wherein said first intensity is greater than said second intensity.

7. An electronic system, as recited in claim 5, wherein said transistor comprises ballistic spin filtering to spin polarize and analyze electrons for operation of said switch.

8. An electronic system, as recited in claim 7, wherein said transistor comprises a pair of magnetically permeable layers, wherein when said magnetically permeable layers are aligned said spin polarized electrons penetrate and when anti-aligned, said spin polarized electrons are attenuated.

9. An electronic system, as recited in claim 8, wherein said magnetically permeable layers are both located in said base.

10. An electronic system, as recited in claim 8, wherein one of said pair of magnetically permeable layers is located in said base and one of said pair of magnetically permeable layers is located in said emitter.

11. An electronic system, as recited in claim 5, wherein said emitter is tunnel coupled to said base across an insulator.

12. An electronic system, as recited in claim 5, wherein said device comprises a buried quantum well within a semiconductor collector, wherein said quantum well is formed of a quantum well material having a lower band gap than adjacent material.

13. An electronic system, as recited in claim 12, wherein said material having a lower band gap has a direct transition for more efficient generation of light in said quantum well.

14. An electronic system, as recited in claim 12, wherein said semiconductor collector further comprises a Schottky contact region.

15. An electronic system, as recited in claim 14, wherein said semiconductor collector further comprises an n type Schottky contact region, an undoped quantum well region, and a p type substrate layer heterostructure.

16. An electronic system, as recited in claim 12, wherein said light emitted by said device comprises photons having an energy approximately equal to the band gap of said quantum well material.

17. An electronic system, as recited in claim 5, wherein said emitter is capable of providing ballistic electrons across said base to said collector when an emitter-base bias is provided with a potential exceeding a collector-base energy barrier.

18. An electronic system, as recited in claim 17, wherein said collector-base energy barrier comprises a Schottky barrier.

19. An electronic system, as recited in claim 5, wherein said device comprises a spin valve transistor having a base-collector barrier, a source for complementary carriers, and a place for recombining to generate said photons.

20. An electronic system, as recited in claim 19, wherein said base collector barrier comprises a Schottky barrier, said source for complementary carriers comprises a p-type substrate layer, and said place for recombining comprises a quantum well.

21. An electronic system, as recited in claim 19, wherein said spin valve transistor includes a base having a first magnetically permeable layer and a second magnetically permeable layer.

22. An electronic system, as recited in claim 21, wherein said first magnetically permeable layer is ferromagnetic.

23. An electronic system, as recited in claim 21, wherein said second ferromagnetic layer has a lower coercive field level than said first ferromagnetic layer so said second layer can be switched without switching said first layer to provide for turning on and turning off current in said device with an intermediate level magnetic field.

24. An electronic system, as recited in claim 23, wherein said spin valve transistor includes a base-collector contact comprising a Schottky barrier diode having a Schottky barrier height.

25. An electronic system, as recited in claim 24, wherein said Schottky barrier diode provides that only ballistic electrons having energy at least equal to said Schottky barrier height are injected into said collector.

26. An electronic system, as recited in claim 25, wherein said transistor comprises a variable emitter-base voltage and an independently variable collector-base voltage.

27. An electronic system, as recited in claim 26, wherein said transistor emits photons only when said emitter-base voltage exceeds a threshold approximately equal to the said Schottky barrier height.

28. An electronic system, as recited in claim 26, wherein said transistor emits photons only when said collector-base voltage exceeds a threshold approximately equal to the difference between said bandgap and said Schottky barrier height.

29. An electronic system, as recited in claim 28, further comprising a first power supply for providing an electrical potential across a collector-base junction of said transistor, wherein when said electrons are injected into said collector over a Schottky barrier with an energy at least equal to energy of said Schottky barrier, the combination of this electron energy and said potential energy provided by said first power supply provides said electrons with enough potential energy to generate photons from recombination in said quantum well.

30. An electronic system, as recited in claim 29, further comprising a second power supply for providing an electrical potential across an emitter-base junction of said transistor, wherein said emitter provides ballistic electrons at an energy exceeding said Schottky barrier when sufficient emitter-base potential is provided.

31. An electronic system, as recited in claim 5, wherein said collector comprises an n type region and a p type region and a region-there-between, wherein said region-there-between has a lower band gap than either said n type region or said p type region so as to trap both electrons and holes for facilitating recombination and photon generation.

32. An electronic system, as recited in claim 31, wherein said region-there-between is undoped or lightly doped.

33. An electronic system, as recited in claim 5, wherein emitter-base contact comprises a second Schottky diode.

34. An electronic system, as recited in claim 1, wherein said device comprises a two-terminal light-emitting transistor, said two terminal transistor comprising a base and a collector, wherein said light is emitted from said collector, wherein said base of said two terminal transistor is exposed for receiving sub-band gap photons to provide internal photo-emission of charges in said base.

35. An electronic system, as recited in claim 1, further comprising a magnetic read head that converts magnetic information into an optical signal.

36. An electronic system, as recited in claim 1, further comprising an array of said devices for storing information and for converting said stored information into optical signals.

37. An electronic system, as recited in claim 1, wherein said single device further comprises amplification.

38. An electronic system, as recited in claim 1, further comprising a power supply, wherein said single device comprises a collector and a base, wherein said power supply is connected for providing a collector-base voltage sufficient to provide secondary electrons by impact ionization to provide amplification.

39. An electronic system, comprising a hot electron metal base transistor having a quantum well for facilitating light emission.

40. An electronic system, as recited in claim 39, wherein said transistor comprises a pair of ferromagnetic layers wherein one of said layers can have its magnetization orientation switched independently of the other layer to facilitate magnetic switching.

41. An electronic system, as recited in claim 39, wherein a first intensity of light is emitted in a first magnetic switch position and a second intensity of light is emitted in a second magnetic switch position, wherein said first intensity is greater than said second intensity.

42. An electronic system, as recited in claim 39, wherein said transistor comprises ballistic spin filtering to spin polarize and analyze said charges for operation of said switch.

43. An electronic system, as recited in claim 39, wherein said metal base comprises a ferromagnetic layer.

44. An electronic system, as recited in claim 43, wherein said metal base comprises a pair of magnetically permeable layers, wherein when said magnetically permeable layers are aligned said spin polarized charges penetrate and when anti-aligned, said spin polarized charges are attenuated.

45. An electronic system, as recited in claim 39, further comprising a magnetic read head that converts magnetic information into an optical signal.

46. An electronic system, as recited in claim 39, further comprising an array of said devices for storing information and for converting said stored information into optical signals.

47. An electronic system, as recited in claim 39, wherein said single device further comprises amplification.

48. An electronic system, as recited in claim 39, wherein said transistor comprises a collector, a base, and a power supply for providing a collector-base voltage sufficient to provide secondary electrons by impact ionization to provide amplification.

49. An electronic system comprising a magnetic storage medium and a read head, wherein said read head includes a single device transducer for receiving a magnetic signal from said magnetic storage medium and converting said magnetic signal into an optical signal.

50. An electronic system, as recited in claim 49, further comprising an optical wave guide, wherein said read head provides said optical output signal to said optical wave guide.

51. An electronic system, comprising an array of memory devices for receiving magnetic information and for converting said magnetic information into an optical signal.

52. An electronic system, as recited in claim 51, wherein said array of memory devices comprises an array of single device memory cells, wherein each said single device memory cell of said array stores said magnetic information and converts said magnetic information into an optical signal.

53. An electronic system, as recited in claim 51, further comprising a magnetic read/optical write display in which all data in said array is converted to said optical signal at once.

54. An electronic system, as recited in claim 51, comprising a magnetic read/optical write random access memory in which data can be read one cell at a time.